

WHAT IS CLAIMED IS;

1. An LSI device etching method for subjecting an LSI device to a plasma etching, the LSI device including Cu interconnection and a low-k film, the LSI device being provided 5 with a diffusion prevention film containing silicon (Si) for preventing diffusion of Cu into the low-k film, the LSI device etching method comprising the step of:

selectively etching the diffusion prevention film against the low-k film, by use of a gas containing sulfur (S) as an 10 etching gas.

2. The LSI device etching process as set forth in Claim 1, wherein said etching gas is selected from SO_2 , SO_3 , SOF_2 , SO_2F_2 , 15 SON_x , SON_xF_y , and SH_2 .

3. An LSI device etching method for subjecting an LSI device to a plasma etching, the LSI device including a silicon (Si)-containing mask material and any of an underlying low-k 20 film and a resist, the LSI device etching method comprising the step of:

selectively etching the mask material against any of the underlying low-k film and the resist, by use of a gas containing sulfur (S) as an etching gas.

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4. The LSI device etching process as set forth in Claim 1,

wherein a gas containing nitrogen (N) and fluorine (F) is mixed with said etching gas.

5. The LSI device etching process as set forth in Claim 4,
5 wherein said gas containing nitrogen (N) and fluorine (F) is selected from NF_3 , NF_3O and N_2F_4 .

6. The LSI device etching process as set forth in Claim 4,
wherein a gas containing carbon (C) is added to said etching
10 gas.

7. The LSI device etching process as set forth in Claim 4,
wherein N_2 , NH_3 , or NO_x is added to said etching gas.

15 8. The LSI device etching process as set forth in Claim 4,
wherein a gas containing hydrogen (H) and halogen is added to said etching gas.

9. The LSI device etching process as set forth in Claim 4,
20 wherein fluorocarbon C_xF_y containing carbon (C) and fluorine (F) is added to said etching gas.

10. The LSI device etching process as set forth in Claim 4,
wherein a rare gas is added as a carrier gas into said etching
25 gas.

11. An LSI device etching method for subjecting an LSI device to a plasma etching, the LSI device having a damascene structure including Cu interconnection, a SiCO low-k film and a SiC diffusion prevention film, the LSI device etching method comprising the step of:

selectively etching the diffusion prevention film against the low-k film, by use of a mixture of SO₂ and NF₃ as an etching gas.

10 12. An LSI device etching apparatus for subjecting an LSI device to a plasma etching, the LSI device including Cu interconnection, a low-k film and a diffusion prevention film, said LSI device etching apparatus comprising:

a plasma treatment apparatus which changes an etching gas into plasma and applies high frequency power to an electrode to thereby etch the LSI device by utilizing ions in the plasma, said plasma treatment apparatus having a treatment chamber being provided with a support table in which said electrode is provided and on which the LSI device is to be placed, the etching gas being introduced into said treatment chamber,

wherein a mixture of a sulfur (S)-containing gas and a nitrogen (N)-and-fluorine (F)-containing gas is used as the etching gas in the step of selectively etching the diffusion prevention film against the low-k film.

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13. The LSI device etching apparatus as set forth in Claim 12,

wherein said plasma treatment apparatus is equipped with a temperature control means for changing the temperature of said support table in an attempt to change an adhesion rate of a radial and reaction product.